

10/2/2018 Agenda

I. Chapter 2 of Neidermeyer's Electroencephalography - Cellular Substrates of Brain Rhythms

a. Basic Standards of understanding

- i. Neurons at rest have a potential of -70mV
- ii. All or none response from neurons
 - i. If you receive a signal, you will receive a whole potential, not a half potential
- iii. Electrodes:
 - i. Geometry of neurons – horizontal to sensors or part of brain
 - ii. Arborization – way the dendrites move out -
 - iii. Localization of synapses – large concentration on ends of neurons
 - iv. Extracellular Resistivity – decay system from signal to sensor
 - v. Position of recording electrodes with respect to cell

iv. More:

- i. Distance is a factor
- ii. Due to resistivity
- iii. You can record signals in clusters from monopoles
- iv. When action potentials occur simultaneously in clusters, they can be recorded from a larger distance
- v. There are also compound potentials
- vi. Monopoles give the largest signal due to clusters (rise and fall)
- vii. Because of aliasing of staggered extracellular potentials
- viii. Singlas electrodes pick up on surface
 1. Density of neuronal sources in given cortical column
 2. Degree of correlation
 3. Decay of signal

v. Signals

- i. Delta $<3.5\text{Hz}$
 1. Have spatial buffering due to glial cell interactions
 - a. Steady depolarization of neurons
 - b. Modulates neuronal excitability
 2. K – complex is an artifact common with delta waves due to their generation
 - a. Sleep – related waves
- ii. Theta $4-7.5\text{Hz}$
 1. Varies between humans and animals
 2. Still associated with sleep

3. Communication between certain sections of the brain
 - iii. Alpha 8-13Hz
 1. Not much is understood about the generation
 2. During daydreaming
 3. Thalamocortical cells coupled through gap junctions
 4. When awake they alias with spindle rhythms
 - iv. Spindle (Sigma)
 1. During early stages of sleep – not important
 - v. Beta 20-40Hz
 1. Wakefulness
 2. Can be seen during REM (sometimes)
 3. Activated during stimulus (moving)
 - vi. Gamma >30Hz
 1. Binds together activities of spatially separate cortical areas
 - a. Allows for fast routing and processing of information
 - vii. Alpha Gamma interactions
 1. Play a role in attention
 2. Monkey focused vs unfocused (focused=gamma unfocused=alpha)
 - viii. Beta Gamma interactions
 1. Motion = Beta
 2. Gamma decreases during motion
 - ix. DC shift
 1. Slight DC shift due to neuronal or glial neuronal interactions
- II. 10-20 international system
- a. 16 channel – 2 channel are reference nodes
- III. Discuss Schedule:
- a. See Google Drive – Corey's schedule
- IV. Progress on electrodes:
- a. AJ, Gao – Gold cup, Disposable deep cup
 - i. Two sets on the way
 - b. Ostin – DIY electrodes
 - i. Next week
 - c. Corey – 3D Printed Electrodes
 - i. Still talking to library
 - d. Testing timeline – place, time, people
 - i. See schedule on Drive
 - ii. Conductive Paint – Graphite is DC only

- iii. Look into copper and silver paint
 - e. Felt pads – punch circles from felt from Michael's
- V. Snapshot Day – Meet in Senior Design lab Thursday October 4th
 - a. What we need to do:
 - i. Posters of 8.5x11"
 - ii. See attached handouts:
 - b. Simple diagram for hardware
 - i. Electrode -> amplifier -> microcontroller -> computer -> user interface
 - ii. Pictures of Emotiv EEG – pictures from Joleen
 - iii. Objective Statement – In order to better educate high school students about brain function, we are developing an educational, low cost EEG that can be made in classrooms. During this year, we are going to determine the least expensive and most reproducible way to create an EEG for under \$100.
 - iv. Value Proposition - ??? - Price of Emotiv Device and software + experience
 - 1. The biggest barrier to introducing high school students to basic neuroscience is the staggering cost of an EEG and the software. Instead of spending \$800 on an EEG device like Emotive, and hundreds of dollars a month on the software, this new EEG will deliver open source software and easily reproducible hardware to open neuroscience to all high schoolers.
 - v. Table of product requirements – reproducible by high school students, under \$100, user friendly and open source software.
 - vi. Schedule: print from Drive
 - vii. Poster board – Corey Grabs poster board
 - viii. Senior Design lab will print color

VI. Wiki master – Corey /Ostin

VII. Assignments

- a. Ostin:
 - i. DIY Electrodes
 - ii. Simple Diagram of hardware
- b. AJ
 - i. Pictures of Joleen
 - ii. Construction Paper
 - iii. Library 3D printer – electrodes
 - iv. Write for snapshot Day
- c. Gao:
 - i. Look into conductive paint – copper or silver, etc.
 - ii. Felt Nodes to go into gold cup or disposable electrodes
 - iii. Read Chapter 3 of EEG book
- d. Corey:
 - i. Software example

- ii. Poster board for next time

VIII. Microcontrollers:

- a. Any inputs?